The Obsessive Compulsive Drinking Scale is a valid Measure of Alcohol Craving in Young Adults

Jason P. Connor, PhD[a,b,c], *Gerald F.X. Feeney, MD*[a,b]*, *Alyssa Jack, BA(Hons)*[de], *Ross McD. Young, PhD*[a,b,d]

[a]Centre for Youth Substance Abuse Research, The University of Queensland, Brisbane, Queensland 4029, Australia

[b]Alcohol and Drug Assessment Unit, Princess Alexandra Hospital, Brisbane, Queensland 4102, Australia

[c]Discipline of Psychiatry, School of Medicine, The University of Queensland, Brisbane, Queensland 4029, Australia

[de]School of Psychology, The University of Queensland, Brisbane, Queensland 4102, Australia

[ed]Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane QLD 4059, Australia

*** Corresponding Author:** Associate Professor Gerald Feeney
Medical Director
Alcohol and Drug Assessment Unit
Princess Alexandra Hospital
Brisbane, Queensland
Australia, 4102

Ph: 0011 61 7 32405191

Fax: 0011 61 7 32407211
E-mail: Gerald_Feeney@health.qld.gov.au

Background

Alcohol craving is associated with greater alcohol-related problems and less favourable treatment prognosis. The Obsessive Compulsive Drinking Scale (OCDS) is the most widely used alcohol craving instrument. The OCDS has been validated in adults with a~~A~~lcohol u~~U~~se d~~D~~isorders (AUDs) which typically emerge in early adulthood. This study examines the validity of the OCDS in a non-clinical sample of young adults.

Methods

Three hundred and nine college students (mean age of 21.8~~79~~ years, *SD* = 4.6 years) completed the OCDS, Alcohol Use Disorders Identification Test (AUDIT) and measures of alcohol consumption. Subjects were randomly allocated to two samples. Construct validity was examined via exploratory factor analysis (*n* = 155) and confirmatory factor analysis (*n* = 154). Concurrent validity was assessed using the AUDIT and measures of alcohol consumption. A second, alcohol dependent sample (mean age 42 years, *SD* 12 years) from a previously published study (n= 370) was used to assess discriminant validity.

Results

A unique young adult OCDS factor structure was validated, consisting of Interference/Control, Frequency of Obsessions, Alcohol Consumption and Resisting Obsessions/Compulsions. The young adult four factor structure was significantly associated with the AUDIT and alcohol consumption. The four factor OCDS successfully classified non-clinical subjects in 96.9% of cases and the older alcohol dependent patients ~~alcohol dependent subjects~~ in 83.7% of cases. Although the OCDS was able to classify college non-problem drinkers (AUDIT < 13, n= 224)

with 83.2% accuracy, it was no better than chance (49.4%) in classifying potential college problem drinkers (AUDIT score ≥ 13, n= 85).

Conclusions

Using the four factor structure, the OCDS is a valid measure of alcohol craving in young adult populations. In this non-clinical set of students, the OCDS classified non-problem drinkers well but not problem drinkers. ~~In this non-clinical population the OCDS was identified as a marker of alcohol dependence severity and discriminated between problem and non-problem drinkers~~.

Studies need to further examine the utility of the OCDS in young people with substance misuse.

Key Words: OCDS; Young Adult; Alcohol; Craving

Excessive alcohol consumption in young adulthood carries significant health and social costs (Ham and Hope, 2003; Jennison, 2004; Teesson et al., 2000; WHO, 2004). Australian emergency department data between 2000-2008 report the highest rates of presentations for acute alcohol problems involved 18-24 year olds of both sexes (Muscatello, et al., 2009). Early exposure to alcohol is a robust marker of subsequent alcohol-related problems (Toumbourou, et al., 2007). A key index of alcohol problems is the urge or strong desire to drink, often described as 'craving" (Sayette et al., 2000; WHO, 2002). Alcohol craving is associated with greater dependence severity and less favourable treatment prognosis (Drummond, 2001; Flannery et al., 2001; Rohsenow and Monti, 1999). The extent to which alcohol craving is a marker of degree of alcohol involvement or problems in younger, non clinical populations is poorly understood (Grusser, et al., 2006; Deas, et al., 2001; 2002). This study investigated the validity of the craving construct in a young adult sample, applying the adult version of the most widely used alcohol craving instrument, the Obsessive Compulsive Drinking Scale (OCDS) (Anton, et al., 1995).

The mechanisms of alcohol craving are complex and involve a combination of fundamental changes in neurobiological structures associated with repeated alcohol use, conditioning and higher order learning (see Anton, 1999 for a review). Different craving profiles occur amongst those who abuse alcohol compared to those who are alcohol dependent (Abrams, 2000; Anton, et al., 1995, Drobes and Thomas, 1999). There is evidence that craving is experienced by some young, recreational drinkers. In samples of recreational drinkers, the application of both the Desires for Alcohol Questionnaire (Love, et al., 1998) and the Alcohol Craving Questionnaire (Singleton et al., 1994) successfully distinguished between heavy alcohol users /bingers and non-bingers. Within a college samples, significant associations have also been identified between current alcohol consumption, drinking frequency and the Approach and Avoidance of Alcohol Questionnaire (AAAQ) (McEvoy, et al., 2004). These studies suggest that

alcohol craving does exist and can be measured in non-dependent populations. Drawing on social learning models (eg. Bandura, 1986; 1999), there may be subtle distinctions between learnt 'desires' to consume alcohol, based on previous positive alcohol use experiences and more biologically derived craving, as experienced in alcohol dependence. While the aetiology of non-dependent craving remans unclear, this phenomena, as measured by existing standardised instruments, holds potential as a marker for alcohol-related problems in non-clinical populations.

The most extensively used craving measurement is the OCDS (Anton, et al., 1995; Connor, et al., 2008). This instrument has not been assessed in a non-clinical, young adult population. An adolescent version of the OCDS, the Adolescent Obsessive-Compulsive Drinking Scale (A-OCDS), was developed for 17-20 year old non-clinical adolescent populations (Deas, et al., 2001; 2002). The A-OCDS consists of two highly correlated factors, *Interference* and *Irresistibility*, that were unusable due to collinearity (Thomas and Deas, 2005). A total of eight OCDS studies have been conducted, all in alcohol dependent and/or abuse samples, with the average age across samples of 41.2 years (range 18-76). Three studies did not undertake factor analyses (Anton, et al., 1995, 1996; Moak, et al., 1998). Four studies have conducted exploratory factor analyses (EFA), generating alternate three (Kranzler, et al., 1999; Roberts, et al. 1999) and four (Bohn, et al., 1996; Connor, et al., 2008) factor structures. Three studies have conducted confirmatory factor analyses (CFA) on separate samples (Bohn, et al., 1996; Connor, et al., 2008; de Wildt, 2005~~1995~~), supporting their respective factor structures. de Wildt, et al. (2005) examined the original obsessive and compulsive OCDS factor structure as well as three and four factor models. They concluded that their theoretical, as opposed to empirically (EFA) driven, Cognitive-Behaviour model was superior fit to existing models. None of the models examined by de Wildt, et al. (2005) met minimum goodness of fit requirements.

This is the first study to examine the potential utility of the OCDS with young adults drawn from a non-clinical sample report alcohol craving, as measured by the OCDS. It aims to assess if the obsessive and compulsive conceptualisation of alcohol craving is experienced similarly, but with reduced intensity, by young adults compared to older adults with a~~A~~lcohol u~~U~~se d~~D~~isorders. It examines construct validity and the factor profile is compared with previous clinical studies. The association of the OCDS with ~~alcohol~~ consumption and alcohol problem ~~dependence~~ severity is examined. Finally, a discriminant analysis is applied across non-clinical and clinical (alcohol dependent) samples to determine if the OCDS can successfully identify subjects with and without alcohol dependence.

Material and Method

Subjects

Three hundred and nine college students (91 male, 209 female, 9 unknown gender) with mean age of 21.8~~79~~ years (*SD* = 4.6 years) were recruited from first year psychology, postgraduate medicine, postgraduate psychology, and second year occupational therapy courses. Of the 399 possible respondents, 77% (309) students completed and returned the questionnaires. Ethical approval for the study was granted by The University of Queensland's Behavioural and Social Sciences Ethical Review Committee. A second, alcohol dependent sample from a previously published study (Connor, et al., 2008) was employed to provide clinical data for discriminant validity testing. This sample consisted of 370 consecutively treated outpatients (251 male, 119 female) with a mean age of 42 years (*SD* = 12 years). Subjects consumed on average 140 grams of alcohol per drinking occasion and scored an average of 25.3~~23~~ on the AUDIT

(Saunders, et al., 1993). On average, subjects reported consuming alcohol at hazardous levels for an average of 22.54 years (*SD*~~sd~~ 11.216, range 3 to 60 years).

Formatted: Font: Italic

Materials

Participants provided age and gender data and completed the following standardised measures:

The Obsessive Compulsive Drinking Scale (OCDS) (Anton et al., 1995). Scores on each item can range from 0-4, with higher scores indicating higher obsessions and compulsions with alcohol. The total score range is from 0-40. An OCDS total score of 7 and above discriminates between social drinkers and alcohol dependent drinkers, with a sensitivity of 93% and a specificity of 98% (Anton, 2000).

The Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al., 1993). This is a self-report measure consisting of 10 items assessing alcohol-related behavior and problems and harmful alcohol consumption (items 1-3), drinking behaviour (items 4-6), adverse reactions to alcohol (items 7-8), and alcohol-related problems (9-10). Scores on items 1-8 can range from 0-4, while items 9 and 10 are scored 0, 2, or 4. Higher scores indicate higher risk and range from 0-40. Scores between 8 and 12 indicate hazardous or harmful alcohol use while scores 13 to 40 indicate likely alcohol dependence (Dolman and Hawkes, 2005; Gache et al., 2005). Saunders et al. (1993) reported high reliability, sensitivity, and specificity of the scale.

Alcohol Consumption. Alcohol consumption was measured using previously validated instruments (Connor, et al., 2000). Alcohol quantity was assessed with the question: "On average how many standard drinks do you usually consume on each drinking occasion?" Participants were provided with pictures of a range of common alcohol servings, which included volume from

colloquial Australian expressions (“pots”, “midis”, “schooners”, etc.). This was then transformed to a standardised measure (i.e. grams of absolute alcohol). Drinking frequency was the average number of drinking days per week, scaled from 0 to 7.

Procedure

Anonymous questionnaires were either completed in class time (n= 195) or a testing session for course credit (n= 114).

Statistical Analyses

Exploratory (via Principal Axis Factoring) and confirmatory (via Structural Equation Modelling [SEM]) factor analyses were performed to determine the ~~construct validity~~factor structure of the OCDS. Multiple regression analyses were employed to assess the concurrent validity of the OCDS. Discriminant analyses were undertaken to determine if the OCDS could differentiate between a dependent (Connor, et al. 2008) and a younger currently non-dependent ~~non-dependent (current)~~ sample; also whether the OCDS could distinguish between non-problematic student drinkers and students identified as likely dependent using an AUDIT cut-off score of ≥13 (Dolman and Hawkes, 2005; Gache et al., 2005).

Results

Descriptive Statistics

Table 1 displays descriptive statistics for the student sample.

Insert Table 1 Here

Exploratory and Confirmatory Factor Analysis

Random missing data points on OCDS items 3, 9, and 12 (less than 2% of the total sample) were imputed using the series mean. A random number generator function was used to assign student participants to Sample 1 (n = 155, 64.3% female) or Sample 2 (n = 154, 71% female). Sample 1 was used to perform an exploratory factor analysis while Student Sample 2 was employed for confirmatory factor analysis.

Exploratory Factor Analysis (EFA)

An EFA using principal axis factoring was performed on Sample 1 to examine the OCDS factor structure. High correlations (>.30) between the factors indicated than an oblique rotation offered the most interpretable solution.

A three-factor solution was initially generated, however simple structure was not achieved. OCDS items 11 and 12 did not load clearly onto any particular factor and did not achieve the criterion loading of .40. Additionally there were communalities below .40 suggesting these items may be explained better by retaining another factor. One (uni-dimensional), two (the *a priori Obsessions* and *Compulsions* structure [Modell et al., 1992]) and a four-factor (Connor, et al., 2008; Bohn, et al., 1996) models were examined to identify the most interpretable solution (Hakstian et al., 1982). The four-factor solution with oblique rotation provided a statistical and conceptually acceptable factor structure. Inter-factor correlations ranged from r = .23 to r = .55.

Horn's Parallel Analysis (PA) test (Thompson, 2004; Ford et al., 1986) provide support for retaining this four-factor structure. The four-factor solution explained 59.7% of the common

variance in OCDS scores. Table 2 displays eigenvalues, per cent variance explained by the factors, item loadings, and communalities.

Insert Table 2 Here

One of the item-pairs (pair 13/14, scored the higher of the two) was separated in this four-factor solution. Item 13 loaded onto Factor 4, while item 14 loaded on Factor 1. There were no cross-loadings, indicating simple structure. The adequacy of this solution was further evidenced by all communalities above .40. Although there were two factors with only two items loading on each factor, these loaded highly (from .63 to .93) and item clustering indicated factors were measuring distinct constructs (e.g. alcohol consumption and time spent thinking about drinking) which may be important to this particular group of college drinkers.

Internal Consistency of the OCDS Subscales

The internal consistencies (Cronbach's alpha) for all subscales were high: *Interference/Control* (.83), *Frequency of Obsessions* (.97), *Alcohol Consumption* (.72), and *Resisting Obsessions/Compulsions* (.78)

Formatted: Font: (Default) Times New Roman, 12 pt

Confirmatory Factor Analysis (CFA):

A CFA was performed to test the four-factor craving structure derived from the EFA. Model fit test statistics for the four-factor model were compared with previously published competing three- and two factor models, as well as a uni-dimensional model.

Four-factor Model. This model specified that each of the 14 OCDS items loaded on only 1 of the 4 latent factors. The items were assigned to the factors they had loaded on in the EFA. All four factors were correlated; however their errors were not. Maximum likelihood was used to estimate the parameters in this over-identified model. This estimation process suggested that the fit of the data to the hypothesised model was significant, $\chi^2 = 178.68$, $df = 71$, $p<.001$. However due to the inherent sensitivity of this statistic to sample size, fit indices were also interpreted. Both the NNFI (.86) and CFI (.89) did not reach the required level (>.90) to conclude that the model optimally fits the data. The GFI (.86) and AGFI (.79) further supported this conclusion.

Other Models. Roberts et al.'s (1999) three-factor model was tested. The two-factor *Obsessions* and *Compulsions* model was also tested (Modell et al., 1992), as well as a one-dimensional model, specifying that all 14 items load on a single factor. Factors in the three- and two-dimensional models were correlated, while errors remained uncorrelated.

Results from all four tested models are shown in Table 3. All models display less than optimal (>.90) fit; with the four-factor model providing the best fit.

Insert Table 3 Here

Concurrent Validity: Multiple Regression Analyses

Three separate multiple regression analyses were conducted to determine whether scores on the factors could predict a significant amount of variance in scores on the AUDIT, Average

Drinking Days/Week and Average Drinks/Occasion in the students. Zero-order correlations between criterion variables were initially examined. AUDIT and Average Drinks/Occasion had a strong, positive, significant correlation, $r = .69$, $p<.01$. AUDIT and Drinking Days/Week had a moderate, positive significant relationship, $r = .41$, $p<.01$. A weak but positive, significant association was found between Average Drinks/Occasion and Drinking Days/Week, $r = .20$, $p<.01$. This indicates considerable shared variance between alcohol problem~~dependence~~ severity (AUDIT) and alcohol consumption measures in this college sample, but no collinearity.

Standard Multiple Regression Results

The significance of the overall relationship, the obtained R^2, standardised regression coefficients (β), and semipartial correlations (sr^2) are shown in Table 4.

Insert Table 4 Here

The four OCDS factors contributed 59% of the variance towards the AUDIT (F [4, 304] = 107.24, $p<.001$). All standardised regression coefficients (β) for each of the predictors differed significantly from zero, indicating that each factor uniquely contributed to the prediction of scores on the AUDIT. Interference/Control was the strongest predictor. The OCDS factors accounted for 26% of the variance towards average consumption per drinking occasion (F [4, 304] = 26.61, $p<.001$). *Frequency of Obsessions* and *Interference/Control* were the only significant contributing factors. Seventy per cent of the variance of the drinking frequency was accounted for by the OCDS (F [4, 304] = 180.87, $p<.001$), with *Alcohol Consumption* being the

most significant factor. Counter intuitively, higher scores on *Resisting Obsessions/Compulsions* (meaning less resistance) were associated with less days spent drinking per week.

Discriminant Capacity of the OCDS Subscales

The four-factor structure derived from the student EFA and confirmed with the CFA was used to discriminate between the current non-dependent college sample (identified with an AUDIT < 13, n= 224) and a sample of alcohol dependent outpatients (n=370). (Connor, et al., 2008). A second descriptive discriminant analysis was undertaken to test whether scores on the same four factors could discriminate between college students identified as potentially alcohol dependent (using an AUDIT score ≥ 13, n= 85) and non-dependent students (AUDIT < 13) (Dolman & Hawkes, 2005; Gache et al., 2005). Figure 1 displays the differences between means for each of the groups on the four factors.

Insert Figure 1 Here

Discriminating between Clinical and Non-clinical Participants

The overall relationship between the grouping and response variables was explained by one significant discriminant function explaining 50% of between group variance, χ^2 (4) = 409.95, p<.001.The discriminant function was able to classify 88.7% of the original grouped cases correctly, with non-clinical participants most successfully classified in 96.9% of cases and clinical participants in 83.7% of cases. All four OCDS factors were able to significantly

discriminate between non-clinical and clinical participants: *Resisting Obsessions/Compulsions* (F [1, 591] = 516.78, p<.001) was the most powerful discriminator, followed by *Interference/Control* (F [1, 591] = 425.14, p<.001), *Frequency of Obsessions* (F [1, 591] = 375.34, p<.001) and *Alcohol Consumption* (F [1, 591] = 181.00, p<.001).

Discriminating between Non-dependent and Possibly Dependent Students

The total sample of 309 was comprised of 224 non-dependent students and 85 possibly dependent students, based on AUDIT scores. The overall relationship between the grouping variable and scores on the factors was explained by one significant discriminant function accounting for 36% of between group variance, χ^2 (4) = 137.48, p<.001. The discriminant function was able to classify 83.2% of the original grouped cases correctly, with non-dependent college students most successfully classified in 96.0% of cases and possibly dependent college students classified correctly in 49.4% of cases. All four OCDS factors significantly contributed to the function, with *Interference/Control*, F (1, 307) = 123.42 p<.001 the most powerful factor, followed by *Resisting Obsessions/Compulsions*, F (1, 307) = 106.97, p<001; *Frequency of Obsessions*, F (1, 307) = 48.50, p<.001 and *Alcohol Consumption*, F (1, 307) = 45.65, p<.001.

Discussion

This study confirms that features of alcohol craving can be reliably measured by the Obsessive Compulsive Drinking Scale (OCDS) in a young adult sample and OCDS scores were associated with alcohol related problems. A unique young adult factor structure was validated. This consisted of four factors- *Interference/Control* (distress, interference of drinking related thoughts, and control over drinking), *Frequency of Obsessions* (time spent thinking about

drinking), *Alcohol Consumption* (quantity and frequency of alcohol consumption) and *Resisting Obsessions/Compulsions* (effort and anxiety associated with resisting drinking). Existing competing models were inferior in comparison with the four-factor model. The young adult four factor structure successfully discriminated between older clinical (alcohol dependent) and non-clinical samples (college students), and identified non-problem college drinkers but not problem college drinkers.

The four underlying craving factors identified in this young adult sample provide further support for the multifaceted nature of craving in both non-problematic and pre-dependent drinkers (Field, et al., 2005; Grusser et al., 2006; McEvoy et al., 2004). The identified factors: *Interference/Control, Frequency of Obsessions, Alcohol Consumption,* and *Resisting Obsessions/Compulsions* were similar to the four factor models obtained (with minor variations) by Connor, et al. (2008) and Bohn, et al. (1996) using alcohol dependent subjects. *Frequency of Obsessions* in the student sample assesses the time spent thinking about alcohol. In the Connor, et al., (2008) study the *Obsessions* factor measures frequency and disturbance caused by these thoughts. This may indicate thinking or preoccupation with drinking for social and/or binge-drinkers is less distressing. In the current study, quantity and frequency of alcohol consumption (OCDS items 7 & 8) loaded on a unique factor. These items in Connor et al. (2008) study loaded across factors highlighting that the young adult sample could much more easily disentangle thoughts about drinking and control over consumption (i.e. compulsion).

The young adult four factor OCDS was able to explain considerable variance in alcohol ~~dependence~~ problem severity and alcohol consumption. Over fifty percent of the overall variance associated with AUDIT scores (*Interference/Control* and *Alcohol Consumption* the most powerful factors), one quarter of the variance in alcohol consumption (*Frequency of Obsessions* and *Interference/Control* the most significant predictor) and over two-thirds of the variance in

frequency of consumption, with *Alcohol Consumption* predictably the strongest contributor. Correlations with alcohol problem indicators observed in this young adult sample are stronger than those reported in previous clinical OCDS validation studies. The non-clinical and clinical samples represented very different levels of ~~dependence~~ alcohol problem severity, as expected. A discriminate analysis applying the four factor OCDS successfully classified college non-clinical subjects in 96.9% of cases and older alcohol dependent ~~subjects~~ patients in 83.7% of cases. Although the OCDS was able to classify college non-problem drinkers (AUDIT < 13, n= 224) with 83.2% accuracy, it was a poor marker of college problem drinkers (AUDIT score ≥ 13, n= 85), with a 49.4% success in classification. The latter finding indicates that the OCDS would not be useful measure of risk in this population. The *Alcohol Consumption* factor did not emerge as an important contributor to successful classification. This adds further support for the notion that the quantity of alcohol consumed may be of less importance in alcohol problems than persistent thoughts/compulsions to drink and the associated resultant interference to day-to-day functioning (eg. Drobes and Thomas, 1999, Tiffany, et al, 2000).

Several limitations of this study should be considered. Measurement of alcohol quantity and frequency was on the basis of subjects' assessment of "average" consumption. This approach has the potential for recall bias, and average indices drawn for more robust timeline follow-back approaches would have been desirable. Some caution is therefore warranted in interpreting these data. Factor analysis is largely dependent on the sample selected and sample differences, including cultural factors and educational which may account for model differences and influence interpretation. Therefore replication in European or American populations may clarify these findings. The study was conducted within a relatively homogenous group of college students studying medicine or allied health courses. Generalizability is also restricted for this reason. Comparisons between clinical and non-clinical samples were also confounded by age and

treatment status, both of which may have resulted in some of the observed differences. The cross-sectional method used does not allow an appraisal of causality. There are limitations in our ability to examine how these four subscales measure craving over time and whether this measurement has utility in the treatment and evaluation of ~~alcohol dependence~~problem severity. This study has highlighted that within the current convenience sample of young adults there is a strong statistical association with the OCDS and problem drinking indices at one point in time. The OCDS may contain ~~dependence~~ alcohol problem severity statements that, by proxy, inflate this association. While a rigorous approach of independent EFA and CFA analyses has been applied to test factor structure, construct validity in terms of the alcohol craving ~~-~~construct (Anton et al., 1995) was not tested. To do this, the OCDS would have required validation against another measure of alcohol craving. It is possible that the alcohol craving construct extends beyond the confines of obsessive-compulsive phenomenology (Drobes and Thomas, 1999; Kavanagh, et al., 2005). The young adult sample included non-drinkers, social/non-problematic drinkers, and binge/harmful drinkers. The craving profile achieved in this sample may have differed if the sample consisted of more precisely delineated drinker groups, including those with significant alcohol problems.

In spite of the difficulties that arise in defining craving, both the theoretical (Tiffany and Conkin 2000) and empirical considerations (Rohsenow and Monti 1999; Bottlender and Soyka 2004, McEvoy et al 2004), many recognise its importance in understanding substance dependence. The OCDS provides robust and reliable measurement of four dimensions of alcohol craving and compulsions in young adult drinkers. It additionally demonstrated strong concurrent and discriminant validity. Further research is required to determine if the OCDS can offer clinical utility in screening young adults and if the scale is associated with developmental trajectories leading to a~~A~~lcohol u~~U~~se d~~D~~isorders.

References

Abrams DB (2000) Transdisciplinary concepts and measures of craving: Commentary and future directions. Addiction 95: S237-S246.

Anton RF (1999) What is craving? Models and implications for treatment. Alcohol Health Res 23:165-173.

Anton RF (2000) Methodological approaches to craving research: Obsessive-compulsive aspects of craving: Development of the Obsessive Compulsive Drinking Scale. Addiction 95: S211-S217.

Anton RF, Moak DH, Latham P (1995) The Obsessive Compulsive Drinking Scale: A self-rated instrument for the quantification of thoughts about alcohol and drinking behaviour. Alcohol Clin Exp Res 19: 92-99.

Anton RF, Moak DH, Latham P (1996) The Obsessive Compulsive Drinking Scale: A new method of assessing outcome in alcoholism treatment studies. Arch Gen Psychiatry 53: 225-231.

Bandura A (1986) Social foundations of thought and action: A social cognitive theory. New Jersey: Prentice Hall.

Bandura, A. (1999) A sociocognitive analysis of substance abuse: An agentic perspective. Psych Sci 10: 214-217.

Bohn MJ, Barton BA, Barron KE (1996) Psychometric properties of the Obsessive Compulsive Drinking Scale. Alcohol Clin Exp Res 20: 817-823.

Bottlender M, Soyka M (2004) Impact of craving on alcohol relapse during, and 12 months following, outpatient treatment. Alcohol Alcohol 39: 357-361.

Connor JP, Jack A, Feeney GF, Young RM (2008)Validity of the obsessive compulsive drinking scale in a heavy drinking population. Alcohol Clin Exp Res 32: 1067-73.

Connor JP, Young RM, Williams RJ, Ricciardelli, LA (2000) Drinking restraint and alcohol expectancies: Which is the better indicator of alcohol dependence? J Stud Alcohol 61: 352-359.

Deas D, Roberts J, Randall C, Anton R (2001) Adolescent Obsessive-Compulsive Drinking Scale: an assessment tool for problem drinking. J Natl Med Assoc 93: 92-103.

Deas D, Roberts JS, Randall CL, Anton RF(2002) Confirmatory analysis of the adolescent obsessive compulsive drinking scale (A-OCDS): a measure of 'craving' and problem drinking in adolescents/young adults. J Natl Med Assoc 94: 879-87.

de Wildt WA, Lehert P, Schippers GM, Nakovics H, Mann K, van den Brink W (2005) Investigating the structure of craving using structural equation modeling in analysis of the obsessive-compulsive drinking scale: a multinational study. Alcohol Clin Exp Res 29: 509-16.

Dolman JM, Hawkes ND (2005) Combining the AUDIT questionnaire and biochemical markers to assess alcohol use and risk of alcohol withdrawal in medical patients. Alcohol Alcohol 40: 515-519.

Drobes DJ, Thomas SE (1999) Assessing craving for alcohol. Alcohol Res Health 23: 179-186.

Drummond DC (2001) Conceptualising addiction: Theories of drug craving, ancient and modern. Addiction 96: 33-46.

Field M, Mogg K, Bradley BP (2005) Craving and cognitive biases for alcohol cues in social drinkers. Alcohol Alcohol 40: 504-510.

Flannery BA, Roberts AJ, Cooney N, Swift RM, Anton RF, Rohsenow DJ (2001) The role of craving in alcohol use, dependence, and treatment. Alcohol Clin Exp Res 25: 299-308.

Ford JK, MacCallum RC, Tait M (1986) The application of exploratory factor analysis in applied psychology: A critical review and analysis. Pers Psychol 39: 291-314.

Gache P, Michaud P, Landry U, Accietto C, Arfaoui S, Wenger O, Daeppen J (2005) The Alcohol Use Disorders Identification Test (AUDIT) as a screening tool for excessive drinking in primary care: Reliability and validity of a French version. Alcohol Clin Exp Res 29: 2001-2007.

Grusser SM, Morsen CP, Flor H (2006) Alcohol craving in problem and occasional alcohol drinkers. Alcohol Alcohol 41: 421-425.

Hakstian AR, Rogers WT, Cattell RB (1982) The behaviour of number-of-factors rules with simulated data. Multivar Behav Res 17: 193-219.

Ham LS, Hope DA (2003) College students and problematic drinking: A review of the literature. Clin Psychol Rev 23: 719-759.

Kavanagh DJ, Andrade J, May J (2005) Imagery relish and exquisite torture: the elaborated intrusion theory of desire. Psychol Rev 112: 446-467.

Jennison KM (2004) The short-term effects and unintended long-term consequences of binge drinking in college: A 10-year follow-up study. Am J Drug Alcohol Abuse 30: 659-684.

Kranzler HR, Mulgrew CL, Modesto-Lowe V, Burleson JA (1999) Validity of the Obsessive Compulsive Drinking Scale (OCDS): Does craving predict drinking behaviour? Alcohol Clin Exp Res 23: 108-114.

Love A, James D, Willner P (1998) A comparison of two alcohol craving questionnaires. Addiction 93: 1091-1102.

McEvoy PM, Stritzke WGK, French DJ, Lang AR, Ketterman RL (2004) Comparison of three models of alcohol craving in young adults: A cross validation. Addiction 99: 482-497.

Moak DH, Anton RF, Latham PK (1998) Further validation of the Obsessive Compulsive Drinking Scale (OCDS): Relationship to alcoholism severity. Am J Addict 1: 14-23.

Modell JG, Glaser FB, Mountz JM, Schmaltz S, Cyr L (1992) Obsessive and compulsive characteristics of alcohol abuse and dependence: Quantification by a newly developed questionnaire. Alcohol Clin Exp Res 16: 266-271.

Muscatello DJ, Thackway SV, Belshaw DA, McGrath D (2009) What can public health surveillance of emergency department presentations for acute alcohol problems tell us about social trends in drinking behaviour? Med J Aust 4: 237-238.

Roberts JS, Anton RF, Latham PK, Moak DH (1999) Factor structure and predictive validity of the Obsessive Compulsive Drinking Scale. Alcohol Clin Exp Res 23: 1484-1491.

Rohsenow DJ, Monti PM (1999) Does urge to drink predict relapse after treatment? Alcohol Res Health 23: 225-232.

Saunders JB, Aasland OG, Babor TF, De La Fuente JR, Grant M (1993) Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption – II, Addiction 88: 791-804.

Sayette MA, Shiffman S, Tiffany ST, Niaura RS, Martin CS, Shadel WG (2000) Methodological approaches to craving research: The measurement of drug craving. Addiction 95: S189-S210.

Singleton EG, Henningfield JE, Tiffany ST (1994) Alcohol Craving Questionnaires: ACQ-Now: Background and administration manual. NIDA Addiction Research Centre, Baltimore, Maryland.

Teesson M, Hall W, Lynskey M, Degenhardt L (2000) Alcohol- and drug-use disorders in Australia: Implications of the National Survey of Mental Health and Wellbeing, Aust N Z J Psychiatry 34: 206-213.

Thomas SE, Deas D. (2005). The A-OCDS predicts both craving and alcohol cue reactivity in adolescent alcoholics. Addict Behav 30: 1638-48.

Thompson B (2004) Exploratory and confirmatory factor analysis. Washington, DC: American Psychological Association.

Tiffany ST, Carter BL, Singleton EG (2000) Methodological approaches to craving research: Challenges in the manipulation, assessment, and interpretation of craving relevant variables. Addiction 95: S177-S187.

Tiffany ST, Conkin CA (2000) A cognitive processing model of alcohol craving and compulsive alcohol use. Addiction 95: 145-153.

Toumbourou JW, Stockwell T, Neighbors C, Marlatt GA, Sturge J, Rehm J (2007) Interventions to reduce harm associated with adolescent substance use. Lancet 369: 1391-1401.

World Health Organisation (2002) The ICD-10 Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines, 10th revision. Geneva: World Health Organisation.

World Health Organisation (2004) Global status report on alcohol. ISBN 92 4 156272 2.